Effects of Frequency of Sensor-Augmented Pump Use on HbA_{1c} and C-Peptide Levels in the First Year of Type 1 Diabetes

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Intensive glucose control after the onset of type 1 diabetes has been suggested to preserve C-peptide production (1–3). In people with type 1 diabetes, sensor-augmented pump (SAP) use improved glycemic control, particularly when used >6 days/week (4). As previously reported, subjects with type 1 diabetes were randomized to either 3 days of in-hospital hybrid closed-loop therapy followed by SAP therapy or usual care (5). In the primary intent-to-treat analysis, no significant differences existed in HbA_{1c} or C-peptide between the two groups at 1 year. In our post hoc analysis, we hypothesized that more frequent sensor use in the SAP group would be associated with lower HbA_{1c} levels and preservation of C-peptide production at 1 year.

Subjects in the SAP group ($n = 46$) were stratified by median SAP use of 12.4 h/day. HbA_{1c} and C-peptide levels were compared at baseline and 3, 6, 9, 12, and 24 months. At 12 months of follow-up, the median HbA_{1c} values for those with SAP use above versus below the median were lower (7.0% [Q1, Q3 6.0, 7.5] vs. 7.7% [7.1, 8.5], $P = 0.007$).

All three C-peptide measures were 50–79% higher at 12 months in the above versus below median SAP use group. However, these nonsignificant trends were no longer present at 24 months. No statistically significant differences were seen in fasting, peak, or area under the curve C-peptide levels between the two groups at any time period over 2 years of follow-up. All three C-peptide measures declined >50% from 12 to 24 months in the high SAP use group, although HbA_{1c} levels remained similar (Fig. 1).

As HbA_{1c} levels remained similar at 12 and 24 months in the above median SAP use group, it can be concluded that factors other than glycemic control were likely related to the >50% reduction in C-peptide production during the second year after diagnosis. In subjects having type 1 diabetes for >1 year, only consistent (≥6 days/week) use of a SAP system was shown to improve glycemic control (2). In our analysis, we stratified subjects by the frequency of use of SAP over the year of follow-up (the primary end point), and median use (12.4 h) was about half the day. This frequency of SAP use may not have been sufficient to reduce HbA_{1c} levels adequately to preserve β-cell function. The drop-off in frequency of continuous glucose monitor use in this and previous studies may be due to less sophisticated earlier-generation continuous glucose monitor technologies, such as the Medtronic Sof-sensor used in the initial study (5). Further studies with larger numbers of subjects who are followed for a longer time period and are using improved technology will be important to further evaluate this hypothesis in the future.

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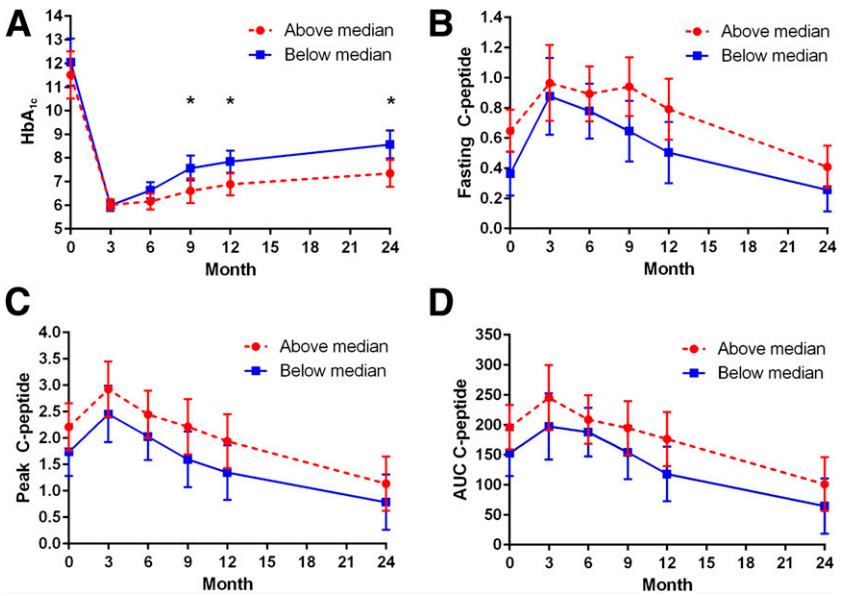

Figure 1—Comparison over 2 years of those who used the SAP above the median compared with those who used the SAP below the median use in the first 12 months. *A*: HbA_{1c} levels (%). *B*: Fasting C-peptide (nmol/L). *C*: Peak C-peptide (nmol/L). *D*: Area under the curve (AUC) C-peptide (nmol min/L). *$P < 0.05$ at 9 months and $P < 0.01$ at 12 and 24 months.

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